ABSTRACT

EPA Science Forum (June 1-3, 2004)

TITLE: Technologies for electric utilities to remove mercury from flue gas air emissions.

EPA has used incentive funding available from the EPS Small Business Innovation Research (SBIR) Program to develop several new sorbent materials that offer more effective and less expensive options for the removal of mercury from electric utility flue gas emissions. Of particular interest to coal-fired power plants is a new sorbent developed by Sorbent Technologies Corporation and other sorbent materials being developed by ADA Technologies and Advanced Fuel Research.

Sorbent Technologies has demonstrated novel duct-injection sorbent materials that effectively capture elemental mercury from coal-fired flue gases when injected into ductwork at modest rates. When the powdered sorbent is then removed by the electrostatic precipitator, the mercury is separated from the gas stream as well. Importantly, the new sorbents appear to be effective at high temperatures (300 F to 400 F). This means that expensive gas-cooling or fabric-filter retrofits are not required and that fly ash sales can remain unaffected. Consequently, preliminary estimates of their cost effectiveness suggest that costs are one-tenth of those estimated for other technologies. Full scale testing has demonstrated in-duct elemental mercury removal of more than 80 percent with an estimated cost of less than $3,000 per-lb-of-Hg removed, one-tenth that of current technologies such as powdered activated carbon.

ADA Technologies has developed a family of new disposable sorbents for mercury removal. The sorbents consist of a natural silicate doped with chemicals to capture and immobilize vapor-phase mercury and mercury compounds. Testing has shown the new materials to have two to three times the capacity for mercury compared to activated carbon, with projected costs lower than those for activated carbon. A reproducible preparation process is being developed for mass production of the sorbent. Testing includes in-house dynamic testing, testing at the Comanche Colorado utility using a slipstream of actual flue gas in the ADA pilot plant. Larger scale testing is also being conducted at the Xcel Energy Arapahoe Plant. ADA and their joint-venture partners expect their high-performance sorbent to be a drop-in replacement for activated carbon, with low capital equipment and installation costs.

Advanced fuel is developing a sorbent derived from waste tires for removal and recovery of mercury from combustion/incineration flue gas. The technology is based on mercury adsorption on low-cost, sulfur-rich activated carbons derived from scrap tires. The sulfur added to tire rubber in the process of vulcanization makes the tire-derived sorbents particularly effective in mercury removal due to the high chemical affinity between mercury and sulfur. Two possible implementations of the process are envisaged: (1) sorbent injection into the flue-gas duct (near-term applications), and (2) a patented regenerative scheme (long-term applications).